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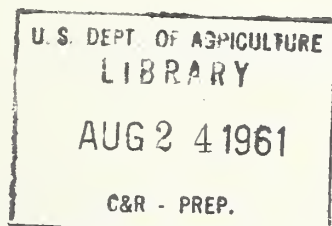
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FOOD STOCKPILING FOR EMERGENCY SHELTERS



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## P R E F A C E

This report on Food Stockpiling for Emergency Shelters is a part of a program of preparedness in the event of a national disaster -- particularly that of a devastating nuclear attack on the United States. If such a disaster should occur, the ability of this country to survive may depend to a great extent on the availability of appropriate shelters adequately stocked with everyday necessities including at least two-week's supply of food and water.

The responsibility for assuring adequate food supplies for the population in an emergency period following nuclear attack must be shared by individuals, local and State Governments, and the Federal Government. It would be impossible for the Federal Government alone to assure adequate food for survivors in a post-attack situation.

The object of this report is to summarize information which should be useful for persons or organizations desiring to establish emergency food reserves in homes or in various types of shelters.

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## FOOD STOCKPILING FOR EMERGENCY SHELTERS

### INTRODUCTION

Although the United States normally produces a surplus of many types of food, national or area shortages of certain foods, or overall shortages in some areas could develop under post-attack conditions. Precautionary measures to minimize possible food problems could improve the ability of this country to recover from a massive attack.

The Department of Agriculture receives many inquiries concerning the need for food stockpiles, as well as suitable kinds of food and procedures for handling them in various types of shelters. This report summarizes the most significant information available on questions concerning the stockpiling of foods. This information is presented to encourage and assist individuals or groups in the development of food stockpile programs for all types of emergency shelter situations including homes, apartment buildings, hotels, schools, public buildings, factories, and office buildings.

Results of studies made, indicate that even without additional food stockpiles, total national supplies of food would be adequate to meet food requirements for survival of this nation's people in a post-attack period. However, possible temporary curtailment or interruption of transportation could disrupt the distribution of food. Also, a nuclear attack and the resulting radiation hazard could force many people to seek protective cover in their homes, factories, or other shelters until radiation decays sufficiently to allow resumption of activities outside shelters. The National Plan for Civil Defense and Defense Mobilization assigns to individuals and families the responsibility "for maintaining personal stocks of food in their homes or shelters sufficient to meet their needs until other supplies are available. These stocks should be sufficient for at least two weeks following attack." <sup>1/</sup> USDA believes that all individuals should have a supply of food where they plan to take shelter in an emergency.

A wide variety of structures could be used for fallout shelters, in addition to those built specifically for shelter purposes. At the time of an attack, many people might be in their homes, whereas many others might be at factories, offices, schools or other large buildings some of which may be equipped with feeding facilities and provide adequate shelter from radioactive fallout. In this study the stockpiling of food is discussed for the following three types of shelter situations:

(1) Family shelters or home basements from which the food reserve may be used and replaced periodically through normal feeding of the family.

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<sup>1/</sup> The National Plan for Civil Defense and Defense Mobilization, Annex 31, National Food Plan, Office of Civil and Defense Mobilization, February 1960, p. 6.

(2) Shelters connected with office buildings, factories, hotels, schools, and other public buildings, where cooking facilities are available and a plan for using and replacing the stored food can be followed in the normal operations of the cafeterias and dining rooms.

(3) Other shelters which may have little or no facilities for preparation or cooking of food and for which rotation of the food stockpile is difficult or impossible. In selecting food reserves for such shelters more attention has to be given to keeping qualities and palatability without further cooking or refrigeration. Periodic inspection will be necessary to be sure that all foods in the shelters are nutritionally safe and that foods no longer edible are removed and replaced.

#### CONSIDERATIONS IN SELECTING FOODS FOR SHELTER STORAGE

The objective of any shelter food-stockpiling program should be to provide an adequate quantity of food to sustain the body and morale of shelter occupants until other food is available. In view of this objective, it is considered desirable that foods have the following characteristics:

(1) A relatively long shelter life. Other conditions being equal, preference should be given to foods having the longest shelf life. Generally, the selection of foods having a longer shelf life reduces the problems of stored food surveillance and replacement.

(2) Palatability. So that the food be at least acceptable to the people in the shelter, it is desirable to stockpile foods which are of the kind usually consumed in the area. Salt and other condiments for use on an individual basis, also should be provided.

(3) Relatively economical. Costs of food for shelters should not be so high as to adversely affect the acceptability of the shelter program. On the other hand, neither should shelter diets be so austere that they may fail to sustain morale of the shelter occupants.

(4) Easily prepared and served. The foods selected should be suited to the available equipment and fuel supply. Therefore, it may be desirable to include some foods that have a reasonable degree of palatability even if they are not heated. In some situations, selections should include simple meals that can be served directly from their containers.

(5) Completely edible. It is desirable that foods be entirely edible to minimize the problem of garbage disposal and save space.

(6) Suitability. Foods selected for a shelter should include items suitable to the prospective shelter occupants. For example,



a school shelter might include quite a different selection of foods than a factory. In most shelter situations outside the home, it is impractical to prepare for diabetics, invalids, infants, or others on special diets. Individuals requiring special diet foods should assure the availability of such food items by providing their own emergency reserve.

(7) Variety in texture and consistency. While milk, soups and juices are nutritious, a reasonable amount of "chewy" and "bulky" foods are needed to add roughage and variety to the meals.

#### Nutritional Levels Recommended for Shelter Feeding

For a period as short as two weeks after a disaster, survival of uninjured persons is not dependent upon an adequate balance of nutrients or even on normal caloric intake. Thus, nutrient requirements may be less important than psychological requirements of shelter occupants. The first requirement after those for uncontaminated air and water, however, is for an adequate supply of calories from foods that also provide some protein, minerals and vitamins. For adults, the source of calories during short periods is not as important as having familiar foods and beverages to ease tension and satisfy hunger. For children, the assortment of foods should receive greater attention.

The results of certain studies indicate that inactive people can get along fairly well with no visible signs of malnutrition for a month or more on 1600 calories a day per person. Moreover, some authorities believe that the adult population could exist for one month on 1200 to 1500 calories a day per person if a food shortage developed necessitating such an austere diet. Of course, these limited numbers of calories would be insufficient to maintain body weight and health over any extended period. It is estimated that an average of 2900 calories (retail level) a day per person are required to sustain body weight and general health of an active, working population for a prolonged period.

Because of problems related to morale of shelter occupants, it appears desirable to avoid planning for a minimum food survival level. Therefore, it is recommended that approximately 2200 calories of palatable food per day per occupant be provided on the basis of rated shelter capacity. Most rations of 2200 calories per day of foods normally acceptable to people in this country would provide enough of essential nutrients including minerals and vitamins to sustain good physical condition for inactive people for a period of two weeks. Hence, supplementation of rations with vitamins and minerals in capsule or tablet form might either be ignored or given secondary consideration for this short time period.

### Composition of a Shelter Food Supply 2/

There is considerable latitude in the combinations of foods that may be used to provide the suggested number of calories in a shelter diet. If possible, at least one food item should be provided daily from each of the major food groups. The quantities used in planning menus and stocking shelters should provide the recommended caloric allowance within the indicated range for each group listed below.

#### Recommended Distribution of Calories by Major Food Groups for Shelter Feeding

<u>Major Food Group</u>	<u>Normal Average</u>	<u>Calorie Distribution Range</u>	
	<u>Distribution</u> (Percent)	<u>for Stockpiling</u> (Percent)	(Number)
Meat and Meat Products	26	10-20	220-440
Milk Products	15	5-15	110-330
Fruit and Vegetables	10	5-10	110-220
Grain Products	25	15-50	330-1100
Fats and Oils	14	5-10	110-220
Sugars and Sweets	10	10-15	220-330
Miscellaneous	<u>(neg.)</u>	---	---
TOTAL	100.0		

### FOOD STOCKPILING IN HOME SHELTERS 3/

A home shelter would be of little use without an accessible supply of food, water, and other needed items. Therefore, the Department of Agriculture concurs with the Office of Civil and Defense Mobilization in urging families to establish and maintain a supply of food and water sufficient for at least two weeks. Those families that do not already keep a two-week's supply of food in their homes should increase it accordingly. Such a supply can be maintained continuously either by (1) increasing the current stock of food normally drawn upon in preparing meals for the family, or (2) by keeping a separate shelter reserve food supply and replacing it periodically.

The first method consists merely of keeping a two-week's supply of food on hand. Individual food items are replaced as they are used in feeding the family. If refrigerators and food freezers become inoperable, the food in them requiring refrigeration (especially fresh milk, meat, poultry, and fish) should be used first to avoid spoilage. If these refrigeration units are opened only once daily, the food in them should remain usable for a reasonable period of time while the family is in a basement or other nearby shelter.

2/ This information is based on data prepared by the Diet Appraisal Branch, Household Economics Division, ARS, USDA.

3/ The information presented in this section is based on that found in "Individual and Family Survival Requirements". Office of Civil and Defense Mobilization, November, 1959.



Food selected for shelter reserve should keep for months without refrigeration, be easily stored and prepared, and require little or no cooking. Thus, such foods could be prepared for family consumption even if gas or electricity for cooking in the shelter are shut off and only a limited supply of water is available. In planning the reserve stock of food, it should be realized that these storable types of foods might constitute the entire diet in an emergency, whereas normally they provide perhaps less than half of the regular family diet.

The food selected should meet the needs and preferences of family members. The suggested quantities of various foods considered sufficient for one adult for two weeks are shown in Table 1. If the family consists of four adults with moderate food needs, four times the amount of food should be stored than that suggested in the guide. Teenagers may need as much or more food and young children may need less food than the amounts in the guide. There should be included, as required, special milk or strained, chopped, or other special foods for infants, toddlers, older persons, diabetics, invalids, and other on a special diet.

Cans and jars in sizes that meet family needs for only one meal each are recommended for meat, poultry, fish, vegetables, fruits, evaporated milk, and other foods which deteriorate rapidly, unless refrigerated, after the container is opened. This also helps to eliminate the problem of storing leftovers.

Foods processed in metal and glass containers and from fresh stocks will stay in good condition for 6 or more months if kept in a dry place, protected from sun and dust, and kept at a fairly cool temperature - preferably not above 70 degrees F. nor below freezing. Food in paper boxes, to be stored as long as 6 months, should be placed in tightly closed metal cans or cabinets and also kept under dry, cool, clean conditions, so that rodents and insects can not get to them. Foods in glass containers should be insulated against damage or shock.

It is desirable to rotate canned foods at least once or twice a year and foods in paper cartons (without added protection) at least every 3 months. This will ensure having a reserve supply of food that has not lost quality. As food from the reserve shelf is used for meals or for any unexpected guests, it should be replaced. Adding the new supply at the rear of the shelves with the older stocks moved to the front will facilitate rotation of the stocks. It is estimated that about 1 3/4 net cubic feet of space is required to store the amount of food sufficient for one person for two weeks.

Should an emergency make it necessary for families to evacuate their homes, they should take with them as much as possible of their emergency food reserves, as some time would be required to establish emergency feeding facilities in reception areas.

TABLE 1—Guide for shelter reserve food supply<sup>1/</sup>

Kind of food	Need per person		Remarks
	Daily	2 weeks	
1. Milk	Equivalent of 2 glasses (fluid)	Equivalent of 7 qts. (fluid)	Each of the following is about the equivalent of one quart of fluid milk: Three 6-oz. cans of evaporated milk. One 14½ oz. can of evaporated milk. Three to 3½ ozs. of nonfat dry milk.
2. Canned meat, poultry, fish, dry beans, and peas	2 servings	28 servings (about 8 to 9 lbs.)	Amounts required for one serving of each food are as follows: Canned meat, poultry, fish—2 to 3 ozs. Canned mixtures of meat, poultry, or fish with vegetables, rice, macaroni, spaghetti, noodles, or dry beans—8 ozs. Thick soups containing meat, poultry, fish, or dry beans or peas—one-half of a 10½-oz. can (condensed).
3. Fruits and vegetables	3 to 4 servings	42 to 56 servings (about 21 lbs. canned)	Amounts required for one serving of each food are as follows: Canned juices—4 to 6 ozs., single strength. Canned fruit and vegetables—4 ozs. Dried fruit—1½ ozs.
4. Cereals and baked goods	3 to 4 servings	42 to 56 servings (about 5 to 7 lbs.)	Amounts required for one serving of each food are as follows (selection depends on extent of cooking possible): Cereal: Ready-to-eat, puffed—½ oz. Ready-to-eat, flaked—¾ oz. Other ready-to-eat and uncooked—1 oz. Crackers, cookies—1 oz. Canned bread, steamed puddings, and cake—1 to 2 ozs. Flour, flour mixes—1 oz. Macaroni, spaghetti, noodles: Dry—¾ oz. Cooked, canned—6 ozs.
5. Spreads for bread and crackers	According to family practices		Examples: Cheese spreads. Peanut and other nut butters. Jam, jelly, marmalade, preserves. Sirup, honey. Apple and other fruit butters. Relish, catsup, mustard.
6. Hydrogenated fats and vegetable oils		Up to 1 lb. or 1 pt.	Amount needed depends upon extent of cooking possible.
7. Sugars, candy, nuts, instant puddings	Daily	2 weeks 1 to 2 lbs.	
8. Miscellaneous	According to family practices		Examples (amount needed depends on extent of cooking possible): Coffee, tea, cocoa. Instant, dry cream substitute. Bouillon products. Synthetic beverage products. Salt and spices (e.g., pepper). Flavoring extracts, vinegar. Soda, baking powder.
9. Water	1/2 gal.	7 gals.	

<sup>1/</sup> Prepared by the Institute of Home Economics, ARS, USDA, and published in "Individual and Family Survival Requirements", Appendix 1 (Annex 2 - Individual Action), NP-2-1, National Plan Appendix Series, Office of Civil and Defense Mobilization, November, 1959, Pages 6 and 7.

In addition to food, a minimum amount of water is required for drinking and food preparation. The minimum requirement is  $\frac{1}{2}$  gallon per person per day or 7 gallons for a two-week period. In an emergency, water may be obtained from hot water tanks, toilet tanks, and refrigerator ice. An additional supply of water should be stored in clean containers, preferably jugs, bottles, or jars with tight-fitting covers. Water for storage should be clean and safe. If there is doubt concerning the condition of the water, it should be tested. Water tested and approved by health authorities should be safe to store. Potable water stored in clean containers should remain palatable indefinitely. Every few months, however, the water containers should be checked for possible leaks and the contents checked for any cloudiness or undesirable appearance or taste. Stale water may be made more palatable by pouring it from one container to another several times to provide aeration. Water purification tablets should be included in the emergency supplies. During emergencies, stored water should be used conservatively to prevent wasting or exhausting the supply too rapidly.

#### A ROTATION FOOD STOCKPILE FOR SHELTERS IN PUBLIC BUILDINGS AND BUSINESS ESTABLISHMENTS

Hospitals, factories, schools and other large buildings that have feeding facilities could establish and maintain stockpiles of food for the employees and others who may be in such buildings at the time of an emergency. The selection of foods can vary depending on what can be used at the facility, the funds available and the composition and preferences of the group to be served. In order to maintain some degree of balance among the various food items, it is necessary before selecting foods to develop the menus to be used and determine how the food is to be served.

To assist those interested in establishing an emergency food stockpile, a list including some of the more suitable foods that can be rotated through a public eating facility has been prepared. Table 2 lists some of the foods which might be used and indicates for each the (1) quantity required for 100 servings; (2) suggested type and size of containers; (3) estimated cost per pound; (4) estimated cost per 1000 calories; (5) net storage space required; and (6) estimated rotation schedule. Many other foods could be included in such a stockpile.

Table 2 was developed from a study <sup>4/</sup> made to determine a feasible method for setting up a rotation food stockpile in the shelter area of a large office building in the Washington, D. C. area. The following discussion concerns the nature of the plans made and the results obtained from the study. Though the plan was developed for a specific situation, the general principles followed could be adapted for use in planning food reserves for other shelter situations such as schools, hospitals, and business establishments.

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<sup>4/</sup> The discussion in this section is based on material found in "Emergency Food Stockpile Report for the Government Printing Office". FMD, CSS, USA, July 1960.



Table 2 - Approximate Weight, Cost Per Pound, and Storage Space Required  
For 100 Servings of Selected Foods

Food Group and Food	Require-:	:Estimated Cost:		Total	:Estimate
	ments	:Type of	:	:Net Space:	:Rotation
	Per 100	:Container:	Per	:Per 1000:	:Required
	Servings:		: lb.	:Calories:	
	(lbs.)		(dollars)	(cu.ft.)	(Months)
<u>Meat and Meat Alternates</u>					
Beans, red Kidney	38	#10 can	.10	.25	1.05 24
Beans, White navy	41	#10 can	.11	.07	1.31 24
Beef, corned	34	6lb can	.58	.59	.59 36-48
Beffstew	26	24oz can	.60	1.08	.64 36-48
Chili con carne, without beans	29	#10 can	.50	.32	.93 36-48
Eggs, whole powdered	3	#10 can	1.15	.43	.18 24-36
Frankfurters	25	1 lb can	.60	.56	.31 36-48
Ham chunks	26	#10 can	.89	.74	.83 30
Hamburgers with gravy	27	#10 can	.55	.75	.86 30
Luncheon meat, pork	13	6 lb can	.48	.37	.32 30
Meatballs & Spaghetti	30	#10 can	.25	.42	.96 36-48
Peanut butter	8	2 lb can	.38	.15	.18 24-48
Soup & gravy base	8	5 lb can	.82	.48	.16 18-24
Tuna fish, white	12	66½oz can	.48	.36	.29 4-6
<u>Milk Group</u>					
Cheese, American processed	6	7 lb can	.42	.25	.20 24
Milk, evap. unsweetened	9	14½oz can	.16	.26	.21 12
Milk, non-fat, dry	8	#10 can	.43	.26	.29 12-24
<u>Fruit Group</u>					
Apple butter	7	#10 can	.12	.14	.17 20-24
Applesauce	25	#10 can	.11	.33	.69 20-24
Grapefruit sections	25	5 lb can	.12	.36	.37 6-12
Jam, strawberry	4	#10 can	.30	.24	.09 20-24
Jelly, apple-blackberry	4	#10 can	.17	.15	.09 20-24
Jelly, blackberry	4	#10 can	.18	.16	.09 20-24
Jelly, strawberry	4	#10 can	.20	.17	.09 20-24
Juice, apple	26	46oz can	.11	.48	.66 20-24
Juice, grapefruit	26	46oz can	.11	.64	.66 6-12
Juice, orange	26	46oz can	.17	.85	.66 6-12
Peaches, halves	25	#10 can	.18	.58	.68 20-24
Pineapple, whole-slices	25	#10 can	.21	.59	.67 20-24
Prunes	20	#10 can	.20	.62	.74 20-24

Table 2 (continued)

Food Group and Food	Require-:		Estimated Cost:		Total	Estimated
	ments	Type of	:	:	Net Space:	Rotation
	Per 100	Container:	Per	Per 1000:	Required	Schedule
	Servings:		lb.	Calories:		
	(lbs.)		(dollars)		(cu.ft.)	(Months)
<u>Vegetable Group</u>						
Beans, snap	30	#10 can	.12	1.45	.88	24
Carrots, sliced	27	#10 can	.10	.78	.75	24-36
Corn, whole grain	37	#10 can	.13	.43	1.02	24-36
Peas, green	23	#10 can	.12	.39	.63	24-36
Potatoes, white, inst. dehyd.	6	#10 can	.32	.20	.18	24-36
Soup, chicken noodle or equiv.	26	52oz can	.32	1.50	.69	12-24
Sweet Potatoes, dry pack	20	#10 can	.18	.37	.74	24
Sweet Pickles	3	1 gal glass	.40	.82	.18	24
Tomato Catsup	3	#10 can	.12	.27	.08	7-12
Tomato Juice	25	46oz can	.09	1.39	.80	7-12
<u>Grain Products</u>						
Biscuit mix, wheat	6	10 lb bag	.20	.13	.15	6
Cereal, corn flakes <u>1/</u>	6	100per ctn	.70	.40	1.49	18
Cereal, rice flakes <u>1/</u>	6	50 per ctn	.71	.40	1.26	18
Cereal, rolled oats	7	42oz ctn	.14	.08	.15	18
Cereal, wheat, farina	7	28oz ctn	.17	.10	.15	18
Cookies, ginger snaps	3	16 lb ctn	.30	.15	.22	1-6
Cookies, vanilla wafers	3	10 lb ctn	.42	.21	.22	1-6
Crackers, soda, salted						
4 cracker envelopes	3	180 pk ctn	.87	.45	1.27	6
Macaroni	8	20 lb ctn	.13	.08	.29	18-24
Rice, parboiled	6	100 lb bag	.18	.10	.09	24
<u>Fats and Oils</u>						
Margarine	2	#10 can	.17	.05	.06	24
<u>Sugar and Sweets</u>						
Candy, coated bar, <u>1 1/4</u> oz	8	24 bar ctn	.45	.22	.65	12-24
Sugar, refined, granulated	2	25 lb bag	.10	.06	.05	30-36
<u>Miscellaneous Foods</u>						
Coffee, roasted, ground	3	2 lb can	.74	-	.14	7-12
Tea, black, loose	<u>1/2</u>	1 lb ctn	1.10	-	.05	12-18

1/ 1 ounce individual packages

The type and size of containers are given as a basis for determining the cost per pound and per 1000 calories as well as the storage space requirements. In general, savings in food cost per pound can be realized by purchasing food in the largest available container suitable for the size of the group to be served. The food cost data shown are primarily averages of price quotations from institutional wholesale food supply sources in the Washington, D. C. area during the fall quarter of 1959. Food prices vary over time and among geographic areas and prevailing local prices would need to be checked to determine the food stockpile cost for a specific time and location.

A stockpile of foods selected from those listed in Table 2 would require about 1 3/4 cubic feet of storage space per person. Around 30 percent additional space might be required over that shown in Table 2 to provide sufficient gross storage space to service a large food stockpile.

The estimated rotations schedule in the table is based on the experience of the Office of the Quartermaster General. The minimum number of months listed in the Quartermaster tables for foods stored at a temperature of 70° F was used in this report. The suggested number of months of safe shelf life for each food item is given as an aid in setting up and maintaining the food rotation schedule. This does not mean that food of these types will always last this long.

Under normal circumstances, the average supply of non-perishable food in the cafeteria inventory should be subtracted from the anticipated requirements for the 14-day emergency period to determine the emergency stockpile requirements. The working inventory at many office buildings consists of between two and three days supply and some of these food items are perishable.

#### Menus and Quantities

Menus should be developed to provide three acceptable meals for each day of a seven-day period. The series of menus can be repeated for the second week of the emergency period. Every reasonable effort should be made to reduce the number of separate food items required for the rotation stockpile. One-dish items may be included for several meals and the same meats and other items can be repeated on different days and still avoid monotony. The menus which will result from a rotation food stockpile will be better than for a minimum stockpile situation because of the need to include food items that are generally served in the cafeteria.

#### Selection of Foods

The selection of specific food items should be based mainly on the estimated shelf life of the food, availability of the desired type and



size of package from normal commercial supply channels, feasibility of rotating the food item through the cafeteria, and cost per thousand calories for selected food items as compared to the cost of possible alternative selections.

The feasibility of rotating the more promising food items must be checked with the Cafeteria Manager. Canned meat items, prepared biscuit mix, and soda crackers would be desirable for any stockpile but are difficult to rotate. Because of the relatively high cost per unit of canned meat products, there is a question as to whether they may be rotated on a competitive price basis with the fresh product. However, since there is less waste in using these canned products and less preparation is required than for fresh meats, the added costs, if any, may be quite small.

#### Cost of the Stockpile

In the Government Printing Office study, the initial estimated purchase cost of the non-perishable food supplies required for the stockpile amounted to an average daily cost of 75 cents per person or about \$10.50 for each person during the 14-day period. With most other menus, stockpile costs would probably vary between fifty cents and a dollar per day.

#### Management and Rotation

In order to assure the physical maintenance of inventory in the food stockpile and to maintain a high rotation-quality level for all foods, it would appear desirable to provide specific administrative responsibility for this management job. Once the operating policy has been established the Cafeteria Manager presumably should be responsible for the purchase, management and rotation of the food stockpile. Since all items should be rotated on a first-in-first-out basis, it would appear desirable to stamp the future rotation date on each package or block of packages when stored.

### FOOD STOCKPILING FOR LONG STORAGE IN PUBLIC SHELTERS

Many problems would occur in frequently rotating food in large public shelters. If a public shelter program is undertaken, only foods with relatively long storage life probably should be stored in such shelters. Public and private groups or organizations may also want to establish food stockpiles in apartment buildings, office buildings and other commercial establishments where rotation through a public eating facility may not be practical.

The foods selected for storage in shelters should have sufficient stability so that the cost of stockpile surveillance and replacement, when added to the initial food-cost, will constitute a minimal food

expenditure per year. In most public shelters, the costs and problems involved in frequently replacing food stocks make it impractical to stockpile foods that have only limited storage life. At such shelters, it is desirable to have types of food that may be stored for periods of at least two to four years before they need to be replaced with fresh stocks.

Since all foods deteriorate eventually, any food reserve must be sampled and evaluated periodically and any food items found to be unsuitable for human consumption should then be replaced. The food stocks should be checked at least once or perhaps twice during the first year of storage, and more often during the remaining years, to determine their suitability for continued storage. If the temperature in a shelter can be kept below 70° F, and the relative humidity less than 50 percent, the rate of food deterioration is reduced and inspections could be less frequent. For most shelters, special equipment to control humidity would be required.

#### Minimum Cost Food Stockpile Items

Shelter food stocks may vary from a supply of such minimum cost items as whole kernel wheat or rice, rolled oats, and granulated sugar to a selection of foods that provide as good a diet as people are willing to pay for. Although in an emergency situation wheat and rice could be eaten in their natural state, they could be made more acceptable for human consumption if grinding and cooking facilities are provided. These low-cost food items if in appropriate containers are storable for longer periods than most processed foods and they would alleviate hunger. However, it is questionable whether such an austere diet would maintain the morale of shelter occupants.

#### "Grocery Store" Foods Suitable for a Shelter Reserve

Many people will want more than a strict subsistence diet in their shelter. The variety of foods that would have a relatively long storage life in shelters is quite limited. Some food items generally storable for about four years or more are listed in Table 3. For each of these food items, the suggested kind of container is indicated as well as the estimated price and calories per pound; the estimated cost, weight, and storage space for a sufficient amount of each food for 100 servings; and the estimated duration of safe storage. Consideration must be given to the fact that when listing food items with long shelf life, an approximation of the period of stability can only be made based on similar products that have been tested. It is impossible to realistically estimate the shelf life of food items procured in normal distribution channels, since such important criteria as when the food was processed and the specifications concerning food quality, packaging, and processing methods affecting their keeping qualities are not always known.



Table 3 - Estimated Weight, Cost and Net Storage Space Required for 100 Servings of Selected Foods Storable for Four Years or More

Stockpile Item	Kind of Container	:	:	:	: Food for 100 Servings		: Estimated
		:	:	:	:	:	: Duration
		: Price Per	: Calories :	:	: Estimated Total	:	: of Safe
:	:	: Pound	: Per Pound:	Cost :	ments :	Space	: Storage 1/
		(dollars)	(number)	(pounds)	(cu.ft.)	(years)	
<u>Meat and Meat Alternates</u>							
Chile Con Carne, without beans	Enamel Lined Cans	.50	907	14.50	29	.93	4
Cheese, Processed	Sealed Cans	.42	1678	2.52	6	.20	4
Eggs, albumen, glucose free	Oxygen-free cans	1.15	2689	3.45	3	.18	4
<u>Milk Products</u>							
Cream, dry, coffee - type	Laminated aluminum foil, rubber hydrochloride packets	.65	2319	4.16	6.4	.29	4
Dry milk, non-fat	Laminated aluminum foil, rubber hydrochloride packets	.43	1643	3.44	8	.29	4 +
<u>Grain Products</u>							
Rice, Unhulled (11.5-13% moisture)	Hermetically sealed containers	.05	1634	.50	10	.23	10 +
Spaghetti	Cartons, water resistant	.13	1712	1.04	8	.29	5
Wheat, whole kernel for use as white flour	50 lbs. per enamel lined sealed can	.03	1656	.30	10	.25	10 +
for use as whole wheat flour		.03	1511	.30	10	.25	10 +
<u>Sugar and Sweets</u>							
Gelatin, plain	Sealed Cans	1.05	1520	.79	.75	.02	4-5
Sugar, granulated	Cloth bags in multi-wall bags	.10	1748	.20	2	.05	10 +

1/ Duration of safe storage varies with the kind of food, type of container and temperature. These estimates are for 70° F..

Under normal conditions, most commercially packaged foods are channeled into markets and consumed within two years of packaging. However, certain foods, including canned meats, fish, pork and beans, baked beans, corn, and peas are not highly corrosive, and, therefore, may be expected to last two to four years even in ordinary commercial containers. On the other hand, some fruits and vegetables such as citrus fruits, asparagus, green beans, spinach, and tomatoes would not be expected to last longer than two years at 70° F. unless packed in hermetically sealed glass or special metal containers. A sample listing of foods storable for at least two to four years is shown in Table 4. Most of these foods are edible with little or no cooking, and would be suitable for storage in an underground shelter. Some, however, require cooking or would be more palatable if served warm. Under favorable storage conditions, many of these items would remain usable for much longer periods.

In canned food, the pigments, nutrients, and other components slowly react and the products of corrosion are dissolved so that eventually the food may become objectionable. Because of this, economy of material and effort can best be achieved by not packaging food items of differing stability in the same master container. Thus, the problems of stockpile surveillance provides an important reason for simplicity in the selection of foods for stockpiling.

#### Increasing Shelf Life of Foods

Any food procured for shelters should be freshly packaged and in undamaged containers. Safe shelf life can be increased by holding down the temperature and humidity in shelters. Fluctuating temperature, together with high relative humidity result in condensation of moisture and rusting of tin cans. Other factors being equal, the shelter life of most food is generally cut in half by an increase in temperature of 18° F. By using this rule of thumb, six months of storage at 106° F. is equivalent to 12 months storage at 88°, 24 months at 70, 48 months at 52, and 8 years at 34 degrees.

In many cases food is made unusable because of rust holes in the containers. Food containers can be protected from moisture by dehumidifying the shelter during the standby period or by placing the stocks in protected rooms or in master containers. The relative humidity of the rooms or master container should not be allowed to exceed 55 percent. The use of a dehumidifier, however, will add somewhat to the cost of food stockpiling. Where humidity cannot be controlled, the can-life may be extended by coating (after closure) with a rust-resistant lacquer or other suitable material.

Though refrigeration could be used to extend the storage life of foods in shelters, it is not considered to be practicable to provide refrigeration for most shelters. The costs of refrigeration in a shelter for a food stockpile could amount to substantially more than the value of the foods stored.

Table 4 - Estimated Weight, Cost, and Net Storage Space Required for 100 Servings of Selected Foods Storable for Two to Four Years

Food Group and Food	Type of Container	Food for 100 Servings					Estimated Total	Duration
		Price Per Pound	Calories	Cost	Requirements	Space		
		(dollars)	(number)	(dollars)	(pounds)	(cu.ft.)		(months)
<u>Meat and Meat Alternates</u>								
Bacon, sliced, canned	Enamel-lined cans	.70	3144	6.30	9	.12		24
Beans, dried	Textile bags in multi-wall paper	.11	1537	1.21	11	.35		36-48
Beef with gravy	Sealed cans	.84	880	15.96	19	.60		36-48
Beef with vegetables	Sealed cans	.46	600	8.74	19	.62		36-48
Eggs whole, glucose free	Sealed cans	1.15	2689	3.45	3	.18		24-36
Fish, canned	Sealed cans	.48	1318	5.76	12	.29		24
Frankfurter, chunks, beans	Sealed cans	.60	723	15.00	25	.31		30
Peanut butter	Sealed cans	.38	2615	3.04	8	.18		24-48
Peas, Dried	Textile bags in multi-wall paper	.09	1541	.99	11	.30		36-48
<u>Milk Products</u>								
Cheese Cheddar, processed	Sealed cans	.42	1680	2.52	8	.20		30-36
Milk, non-fat, dry	Metal cans	.43	1643	3.44	8	.29		24
<u>Fruits and Vegetables</u>								
Beans, canned	Sealed cans	.12	83	3.60	30	.88		36
Carrots, canned	Sealed cans	.10	128	2.70	27	.75		24-36
Corn, canned	Sealed cans	.13	302	4.81	37	1.02		36
Peas, canned	Sealed cans	.12	307	2.76	23	.63		36
Potato granules, instant	Sealed cans	.32	1619	1.92	6	.18		24-36



Table 4 continued

Food Group and Food	Type of Container	: Food for 100 Servings					: Duration
		: Price Per:Calories :	: Estimated Total	: Require-:Net Stge.: of Safe	: Space	: Storage 1/	
		: Pound :Per Pound: Cost :	: (number) (dollars) (pounds) (cu.ft.) (months)	: ments :			
<u>Grain Products</u>							
Corn Meal, degerminated	Sealed Cans	.12	1650	.72	6	.15	24-36
Crackers, soda, salted	Sealed Cans	.28	1955	.84	3	1.27	36-48
Hominy, whole kernel	Sealed Cans	.08	1642	.40	5	.14	36
Macaroni Products	Fiberboard Cartons	.13	1712	1.04	8	.29	24
Rice, parboiled	Asphalt-laminated paper bags	.18	1734	1.08	6	.09	36
Roiled oats, regular flaked, or quick	Sealed Cans	.14	1770	.98	7	.15	36-48
Tapioca, granulated	Asphalt-laminated paper bags	.42	1955	.84	1 1/2	.04	24-36
<u>Fats and Oils</u>							
Margarine	Lacquer-lined cans	.17	3269	.34	2	.06	24
<u>Sugar and Sweets</u>							
Candy, hard	Grease-proofwrap, chipboard	.36	1738	1.08	3	.10	24-36
Dessert powder with cornstarch	Metal cans & fiberboard	.19	1724	.76	4	.11	24-36
Cake, pound	Sealed Cans	.40	1972	4.80	12	1.04	48
Gelatin, plain, domestic	Fiberboard packages	.95	1520	.71	3/4	.02	24-36
Sugar, refined, granulated	25 pound bag	.10	1748	.20	2	.05	30-36
<u>Miscellaneous Foods</u>							
Coffee, soluble	Sealed Cans	.74	--	2.22	3	.14	30-36
Tea, soluble	Cans, glass, & envelopes	1.10	--	.55	1/2	.05	36

1/ Duration of safe storage varies with the kind of food, type of container and temperature. These estimates are for 70° F..

### Development of Special Stockpile Foods

The foregoing discussion has been concerned with what may be called the "grocery store foods" approach to shelter stockpiling. This approach is emphasized because such foods are easily obtainable for immediate use in developing shelter food reserves. Another possible approach to shelter stockpiling would involve the use of "modified grocery store foods". Some grocery store items might be included, but the less stable food products would be replaced by special procurement items. Metal containers for dry food items and containers of more durable glass or heavier tinplate for other foods would increase the initial cost of food supplies but provide more stability, require less expensive surveillance and less frequent replacement. Moreover, by the use of special packaging, it would also be possible to increase variety in the shelter diet. But all of these measures would add to procurement costs.

Still another approach to food stockpiling could be through the development and use of new food products uniquely suited to the problems of shelter supply and shelter service. The necessary technology exists for new food product development as demonstrated by the production of certain special use foods and freeze-dried foods. For example, a compressed cereal bar has been developed that can be bulk packaged and eaten with cheese, jam and peanut butter; served with milk as either a cold or hot cereal; or mixed with hot soups, gravy or sauce as an entree for lunch or dinner. Although this type of food product is relatively inexpensive, it is still in the developmental stage and does not have general public acceptability.

Further research and product development as well as extensive commercial and promotional development would be needed before the latter approach to emergency food stockpiling can be properly tested and appraised for general use. In the meantime, shelter programs should use the "grocery store" approach to food stockpiling. A careful evaluation of future experience in stockpiling food in shelters should be made to provide a means for improving future food-stockpiling programs.





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